

REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 5-9 and 11-13 are active in this case, Claims 5 and 7 having been amended by the present amendment. It is respectfully submitted that no new matter is added by this amendment.

In the outstanding Office Action Claims 5, 7-9, 11, and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Feng (U.S. Patent No. 6,417,037) in view of Park et al. (U.S. Patent No. 6,465,866, hereinafter Park). Claims 6 and 12 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Applicants thank the Examiner for the indication of allowable subject matter in Claims 6 and 12. However, since Applicants believe amended Claim 5 defines over the cited art, Claims 6 and 12 have been maintained in dependent form. In view of the present amendment and in light of the following comments it is respectfully requested that the objections to Claims 6 and 12 be withdrawn.

Applicants also thank Examiner Owens for the interview granted Applicants' representatives March 16, 2004. During the interview, the present amendments to Claims 5 and 7 were discussed with regard to the references of record.

In light of the outstanding rejection and the discussion during the March 16, 2004 interview, Claims 5 and 7 have been amended consistent with the specification to further distinguish the claims over the cited references.¹

Briefly recapitulating, the semiconductor device as in amended Claim 5 includes, "first and second transistors located respectively on first and second active regions which are

¹ Applicants' specification at least at page 17, lines 13-15.

defined by and in direct contact with said isolation insulating film.” A first gate insulating film is located on the first active region and a second gate insulating film is located on the second active region. The thickness of the first gate insulating film is greater than the thickness of the second gate insulating film. Further, the isolation insulating film defining and contacting the active regions in Claim 5 has a “recessed portion in an edge portion on the side of said first active region, ..., a depth of said recessed portion is defined as a vertical height between a main surface of said first active region and a deepest part of said recessed portion, and is not less than 10 nm.”

With regard to Claims 5, 7-9, 11, and 13 under 35 U.S.C. § 103(a) as being unpatentable over Feng in view of Park, that rejection is respectfully traversed.

As noted in the outstanding Office Action, Feng does not teach a semiconductor device, wherein the isolation film has a recessed portion in an edge portion on the side of the active region.² The outstanding Office Action relies on Park as teaching “a semiconductor device (Figure 4), wherein the isolation film (50) has a first and second recessed portion in an edge portion on the side of the active region.”³ However, 50 in Figure 4 of Park refers to a nitride film liner. Park states “that the top ends of the liner are recessed by 0 to 500 Å from the surface of the semiconductor substrate, so that the upper edges of a trench are satisfactorily rounded.”⁴ However, Park also describes an “inner wall oxide film 48 formed along the inner wall of the trench,” which contacts the active region. The recessed nitride liner 50 is located between the inner wall oxide film 48 and trench filled with CVD oxide film 52. Therefore, neither the nitride liner 50 nor the isolation insulating film of CVD oxide 52 directly contacts the active region.

² Office Action mailed February 25, 2004, page 2, lines 19-23.

³ Office Action mailed February 25, 2004, page 2, line 23 to page 3, line 2.

⁴ Park, column 2, lines 60-63.

Conversely, amended Claim 5 recites a semiconductor device including, “first and second transistors located respectively on first and second active regions which are defined by and in direct contact with said isolation insulating film.” As above noted, Park discloses having an inner wall oxide film between the isolation insulating film and the active region and no direct contact between the active region and the isolation insulating film. Therefore, Park does not describe or suggest the semiconductor device as in amended Claim 5.

Further, amended Claim 5 defines the depth of the recessed portion around the active region as “a vertical height between a main surface of said first active region and a deepest part of said recessed portion, and is not less than 10 nm.” The recessed portion as in amended Claim 5 is defined with respect to an isolation insulating film to address the problem shown in Figure 13 of the Applicants’ specification. As disclosed by the Applicants, the threshold voltage depends on the depth of the recess around the active region, but there was little understanding of the exact characteristic of the dependency.⁵ Therefore, Applicants made a wide range of variations in the depth of the recess to obtain data about the dependency.⁶ Applicants then determined that if the recess around the active region is at least 10 nm as recited in amended Claim 5, there is little variation in the threshold voltage.⁷ The liner in Park serves an entirely different purpose, i.e., to increase the amount of oxidation at the upper edges of the trench which results in the rounding of the upper edges of the trench during the subsequent forming of the gate oxide film. To achieve this stated purpose, the Park patent teaches recessing the liner 0 to 500 Å, which is a range including the 0 to 10 nm in which the Applicants have determined the threshold voltage is highly dependent on the depth of the recess. Therefore, it is apparent that Park does not recognize the problem disclosed by the Applicants or the solution thereto. Absent hindsight, there is no motivation

⁵ Applicants’ Specification, page 21, lines 10-24.

⁶ Id.

⁷ Id.

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to combine Feng in view of Park, and the combination would include an inner wall oxide film and a nitride liner. Combining only isolated teachings from Park with Feng to reconstruct the Applicants' claimed invention is impermissible under 35 U.S.C. § 103. Therefore, the outstanding rejection under 35 U.S.C. § 103(a) has been overcome, and it is respectfully submitted that the rejection be withdrawn.

As a result, Feng in view of Park does not disclose or suggest the semiconductor device of independent Claim 5 or independent Claim 7, which has been amended to include substantially the same limitation as amended Claim 5. In view of the apparent patentability of amended Claim 7 for the reasons above noted, it is respectfully submitted that Claims 8, 9, 11, and 13 which depend from Claim 7 are patentably distinguishable over the prior art of record. Applicants respectfully request that the rejection of Claims 5, 7-9, 11, and 13 under 35 U.S.C. § 103(a) as being unpatentable over Feng in view of Park be withdrawn. Similarly, it is respectfully requested that the objection to Claims 6 and 12 as being dependent on a rejected base claim be withdrawn.

Consequently, in view of the present amendment and light of the above comments, no further issues are believed to be outstanding in this application, and the present application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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